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EVIDENCE BEARING ON A POSSIBLE NORTHEASTWARD EXTENSION OF MISSISSIPPIAN SEAS IN ILLINOIS

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Introduction.—For some time it has been known that fossils of Mississippian age can be collected within the city limits of Chicago. These Mississippian fossils, which occur in bowlders in the glacial drift, were brought to notice by Mr. William Johnston, who reported them to Professor Weller in 1915. The collections which form the basis of the present report are in part those first secured by Mr. Johnston; others have been collected by Professor Weller, and still others by the writer.

Location of the bowlders.—The drift bowlders which have afforded the fossils occur in the southeastern portion of the clay-pit of the Carey Brick Company, located near the northeastern corner of Grand Avenue and New England Avenue, in the northwestern portion of the city, between Hanson Park and Montclare, being closer to the latter place. The clay-pit is excavated in a terminal moraine, which belongs either to the lake border or to the Valparaiso morainic system, but probably to the former.[1] The morainic material contains a considerable number of glacial bowlders of various types and sizes. Some of them are of igneous origin, others carry fossils of Niagaran age. Those containing the Mississippian fauna were observed only in the southeastern part of the pit. The bowlders have been piled into many small heaps by the workmen, several of which are made up almost exclusively of those of Mississippian age. The collections which have been made were largely secured from these piles, but similar bowlders may be found scattered over the southeastern part of the floor of the pit.

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[1] *Areal Geology Sheet*, Chicago Folio.

Lithologic character of the bowlders.—In their lithologic character these Mississippian bowlders are dolomitic limestones, which closely resemble the Niagaran dolomite of the Chicago region in general appearance; when fresh they are bluish gray in color and very hard, but on weathering they take on an earthy, yellowish-brown color and become very soft.

Physical condition of the bowlders.—The great majority of the bowlders have well-weathered surfaces, and in many examples the outer surface to the depth of an inch or more is decomposed to a soft, yellowish, more or less porous rock as a result of weathering. Some large pieces are completely weathered to the center. This weathered condition of the Mississippian bowlders is, in general, in marked contrast to that of the bowlders of other ages found in the pit. Many of the Mississippian bowlders are rather angular, and none have well-worn faces; they vary in size from small fragments up to irregular blocks containing two or more cubic feet; in general, they lack the characteristic appearance of typical glacial bowlders. If their location were not known, they might easily be mistaken for residual fragments of weathering.

So far as now known, these bowlders are confined to the southeastern section of the Carey clay-pit. A few small masses with the same lithological character were found on the surface of the moraine near the pit, but as none of these fragments have afforded determinable fossils they cannot be identified with certainty.

Criteria by which the bowlders may be recognized.—The Mississippian drift bowlders commonly may be recognized by their dirty, yellowish, weathered surfaces and by their two most marked paleontological characteristics, namely, (*a*) an abundance of crinoidal remains, mostly stems, and (*b*) the presence of numerous specimens of *Spirifer* with plicated fold and sinus.

The fauna of the bowlders.—These bowlders are abundantly fossiliferous, but the fossils are largely fragmentary and are commonly poorly preserved. Unfortunately they are nearly all in the form of molds, a condition of preservation which has added to the difficulties of their identification. None of the fossils are silicified, but a few of the cavities left by the solution of the shells are sprinkled with crystals of pyrite and dolomite. The extremely weathered portion of the rock is generally too soft to yield determinable fossils, and the unweathered portions yield comparatively few. The great majority of the better specimens have been collected from the partially weathered portions.

The most abundant fossils are the crinoids, although most of the specimens are mere fragments of stems, few of which can be identified even generically, and they are of little scientific value except to show that the rock has been a conspicuously crinoidal limestone. Next to the crinoids the brachiopods are the most common fossils, and owing to their abundance and better state of preservation they form the most satisfactory element of the whole fauna. Besides the crinoids and the brachiopods the fauna contains corals, blastoids, bryozoans, pelecypods, and gastropods, none of which are represented by numerous species or specimens.

The composition of the fauna is shown by the accompanying list of species that have been identified (Table I). The number of examples of each species that has been observed is recorded after each name for the purpose of showing the relative importance of the several members of the fauna; the geologic range and geographic distribution are shown in the several columns.

The geographic and geologic relationships of the fauna.—The geographic and geologic relationships of this fauna are not difficult to determine. Considering first the brachiopods, the list shows that all the forms are found in the Mississippi Valley, although a few species have a wider range. Of these brachiopods, two species, *Spirifer gregeri* and *Spirifer mundulus*, are Lower Burlington. Three species, *Dielasma burlingtonensis*, *Spirifer forbesi*, and *Spiriferella plena*, are confined to the Burlington. Seven species,

TABLE I

LIST OF THE MONTCLARE MISSISSIPPIAN FOSSILS

Name	Number	Geologic Range				Geographic Distribution			
		Pierson	Fern Glen	Burlington	Keokuk	Iowa	Illinois	Missouri	Other Localities
Corals (unidentifiable),	10								
Crinoidea (exclusive of stems)									
Disygocrinus rotundus ? Shumard	1			●		●	●	●	
Dorycrinus unicornis Owen & Shumard	1			●		●		●	New Mexico
Platycrinus sp.	2	●	●	●		●	●	●	
Unidentifiable fragments	15								
Blastoidea									
Cryptoblastus melo Owen & Shumard	3			●		●	●	●	
Bryozoa									
Fenestelloid fragment									
Brachiopoda									
Athyris lamellosa Leveille	2	●	●	●	●	●	●	●	Indiana, Kentucky, Ohio, New Mexico, Nevada, Wyoming, Europe
Brachythyris suborbicularis Hall	8			●	●	●	●	●	Indiana
Chonetes multicostus Winchell	2		●	●		●		●	Tennessee
Cliothyridina prouti Swallow	1		●			●	●	●	New Mexico
Cyrtia ? inexpectans ? Weller	1				●			●	
Dielasma burlingtonensis ? White	2			●		●		●	Nevada
Leptaena analoga Phillips	1	●	●	●		●	●	●	Ohio, New Mexico, Nevada, Utah, Wyoming, Nova Scotia
Productus fernglenensis Weller	10	●	●					●	
Pseudosyrinx sp. ?	2	●	●	●	●	●	●	●	
Ptychospira sexplicata White & Whitfield	1		●			●	●	●	
Rhipidomella burlingtonensis Hall	32	●		●		●	●	●	Utah ?
Schizophoria swallovi Hall	16	●		●		●	●	●	
Spirifer forbesi Norwood & Pratten	1			●		●	●	●	
Spirifer gregeri Weller	16			●				●	
Spirifer mundulus Rowley	1			●				●	
Spirifer shepardi Weller	104	●						●	
Spiriferella neglecta ? Hall	1				●	●	●	●	
Spiriferella plena Hall	1			●		●	●	●	
Syringothyris sp. ?	2		●	●	●	●	●	●	
Pelecypoda									
Aviculopectan sp. ?	1			●		●	●	●	
Conocardium sp. ?	1			●		●	●	●	
Gastropoda									
Euomphalus latus Hall	6			●		●	●	●	Ohio
Platyceras obliquus ? Keyes	1			●		●		●	
Platyceras paralius ? White & Whitfield	1		●	●		●		●	Ohio

For range and distribution see *U.S.G.S. Bulletin 153; Illinois State Geological Survey, Monograph I;* Walker Museum Collection.

Athyris lamellosa, *Brachythyris suborbicularis*, *Leptaena analoga*, *Ptychospira sexplicata*, *Rhipidomella burlingtonensis*, *Schizophoria swallovi*, and *Chonetes multicostus*, are not limited to the Burlington; but the Lower Burlington seems to be the upper limit of *Chonetes multicostus*, *Leptaena analoga*, and *Ptychospira sexplicata*, while *Rhipidomella burlingtonensis* and *Schizophoria swallovi* are not found above the Burlington. Two species, *Cliothyridina prouti* and *Productus fernglenensis*, are found typically in the Fern Glen, and one species, *Spirifer shephardi*, is typical of the Pierson limestone of southwestern Missouri, which may be the equivalent of the Fern Glen. The Fern Glen commonly has been classed as uppermost Kinderhook, but it is altogether probable that it should rather be considered as lowermost Osage. Species of the two genera *Pseudosyrinx* and *Syringothyris* are found in the Burlington. One species, *Cyrtia inexpectans*, which is very rare, has been described from residual chert in Missouri, supposed to be of Keokuk age, and another species, *Spiriferella neglecta*, is found in the Keokuk, but these two species are the least certainly identified of any of those recorded.

The brachiopods of the foregoing list are clearly related to those of the early Osage faunas of the Mississippi Valley, as these faunas are developed in Iowa, Illinois, and Missouri, and the formation from which they have originated may be certainly correlated as not younger than the Burlington limestone, and in all probability as Lower Burlington.

The other elements of the fauna confirm the correlation suggested by the brachiopods. The abundance of crinoidal remains immediately suggests the Burlington limestone. Both *Dizygocrinus rotundus* and *Dorycrinus unicornis* are typical Burlington crinoids. *Platycrinus* is also found in the Burlington, though it is not confined to that formation. The blastoid *Cryptoblastus melo* is another member of the Burlington fauna and is quite limited in its geologic range. The gastropod *Euomphalus latus* is another characteristic Burlington species, and both species of *Platyceras* recorded are reported from the Burlington limestone. The corals, bryozoans, and pelecypods which have been recorded have not been specifically identified, but all the genera recognized are known to be present in the Burlington.

The place of origin of the bowlders.—As Montclare is 165 miles in a northeasterly direction from the nearest known Mississippian outcrop in the Mississippi Valley, the question at once arises: From where were these Mississippian bowlders transported by the glaciers? The general direction of ice movement in the Chicago region during the last glacial epoch was somewhat west of south, the published records of the directions of glacial striae west of the city showing directions varying from S. 57° W. to due west.[1]

Considering the known direction of glacial ice movement, the first inference is that the bowlders may have been transported from the known Mississippian outcrops in Michigan, but a careful consideration of the Mississippian formations of that state and of their faunas makes such an origin highly improbable.

The Mississippian section of Michigan as given by Lane[2] has been followed by all later writers.

In this section the following subdivisions are recognized:

Bayport or Maxville limestone: Light and bluish cherty limestones and calcareous sandstones.

Michigan series: Dark or bluish limestones and dolomites, with gypsum and blue or black shales; some reddish or greenish shales and dark or red sandstones.

Marshall sandstone: White and red sandstone, often pyritic, peanut conglomerates, sandy shales, whetstones, and red shales.

Coldwater series: Blue shales with nodules of iron carbonate, sandstone, subordinate streaks of fine-grained limestone, black shale at the base.

Berea sandstone: White sandstone, nowhere exposed in the state.

The published list of fossils from these Michigan formations[3] shows them to be faunally related to the Mississippian of Ohio rather than to the Mississippi Valley formations. Writers are not altogether in accordance regarding the correlation of these formations, but, giving the widest possible latitude, the Montclare bowlders must have been derived from a formation whose age was included within the time of deposition of the Coldwater, Marshall, and Michigan formations of Michigan. The published faunal lists from all these formations are made up largely of pelecypods, and from all the available lists a single species, *Spirifer forbesi* (and this identification is admitted to be very questionable), is recorded from the Michigan series, which has been identified in the Montclare collection. Even if the identification of this species from Michigan is correct, it is still quite evident that the Montclare bowlder fauna has no relationships with the Michigan Mississippian which are worthy of consideration. Furthermore, the lithologic character of the Montclare bowlders is totally different from that of any of the Michigan formations.

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[1] *Chicago Geological Folio*, pp. 506.

[2] *Annual Report, Geological Survey of Michigan*, 1908, pp. 74–86. (1909.)

[3] *Geological Survey of Michigan*, Vol. VII, Part II, pp. 253–70.

From the foregoing consideration of the faunal and lithologic characteristics of the Mississippian formations of Michigan it may be assumed as a demonstrated fact that the Montclare bowlders were not transported from across Lake Michigan to their present resting-place.

The only alternative conclusion in regard to the source of these bowlders is that they were originally in place at no great distance from where they now lie. Such a conclusion is further confirmed by the physical condition of the bowlders themselves. They are angular in outline and exhibit much less wear than most of the associated bowlders. The present weathered condition of the bowlders is probably original weathering accomplished before they were moved by the glacier. This is suggested by the different degrees of weathering of the bowlders themselves and by the different surfaces of the same bowlders. Furthermore, the other bowlders of similar composition which were buried with the Mississippian bowlders in the glacial débris are still essentially unweathered, even upon their surfaces.

Conclusions.—A study of these Montclare glacial bowlders of Mississippian age seems to establish the following important conclusions:

1. There existed, previous to the last glacial advance, an outlier of Mississippian rocks in northeastern Illinois, probably resting on limestone of Silurian age. The remnants of such an outlier may well be in existence, completely buried at the present time by

glacial drift. The actual position of this outlier cannot now be determined, but it was at no great distance from the present position of the bowlders and may well have been within the present limits of Chicago.

2. The limestone comprising this Mississippian outlier contained a prolific fauna of brachiopods, crinoids, and other forms of life, every species of which, so far as they have been certainly identified, is present also in the rocks of lower Osage age in the Mississippi Valley. The whole association of species suggests a very definite correlation of these Mississippian rocks with the Lower Burlington limestone of western Illinois, Iowa, and Missouri. There is no suggestion whatever of any faunal connection with the Mississippian formations of Michigan.

3. On the basis of the two foregoing conclusions, the extension into northeastern Illinois of the Mississippian sea, which occupied the Mississippi Valley region in early Osage time, may be assumed.